Claims

1. A heating apparatus (1) for the conductive heating of melts (39), in particular for the rapid melting-down, refining and/or conditioning of melts (39), which apparatus comprises at least one electrode (3), characterized in that the heating apparatus (1) has at least a first cooling system with means for controlling the cooling power variably as a function of time and location in a plurality of selectable regions of the electrode (3).

2. The heating apparatus as claimed in claim 1, characterized in that the first cooling system comprises a fluid-delivery device (21), which preferably allows the fluid to be delivered at low pressure differences of up to 1 000 mbar, preferably up to 500 mbar, most preferably up to 150 mbar.

3. The heating apparatus as claimed in claim 2, characterized in that the fluid-delivery device (21) can be set and/or controlled in particular with respect to the temperature, the liquid content and/or the quantitative flow of the fluid.

4. The heating apparatus as claimed in claim 2 or 3, characterized in that the first cooling system comprises a multiplicity of fluid-conducting passages (10).

5. The heating apparatus as claimed in claim 4, characterized in that at least portions (19) of the fluid-conducting passages (10) run transversely with respect to one another in different planes.

6. The heating apparatus as claimed in one of claims 1 to 5, characterized in that at least one fluid-conducting

passage (10) is connected to a device for setting and/or controlling the through-flow of cooling fluid.

7. The heating apparatus as claimed in claim 6, in which the device for setting and/or controlling the through-flow of cooling fluid comprises a setting or control valve (13).

8. The heating apparatus as claimed in one of claims 1 to 7, characterized in that the first cooling system comprises air cooling and/or liquid cooling and/or aerosol cooling.

9. The heating apparatus as claimed in one of claims 1 to 8, characterized in that it includes a further cooling system and means for setting and/or controlling the cooling systems independently of one another.

10. The heating apparatus as claimed in claim 9, characterized in that the further cooling system comprises a multiplicity of fluid-conducting passages (12).

11. The heating apparatus as claimed in claim 10, characterized in that at least sections (18) of the fluid-conducting passages (12) of the further cooling system run transversely with respect to sections (19) of fluid-conducting passages (10) of the first cooling system, preferably in a direction perpendicular to the heat propagation direction.

12. The heating apparatus as claimed in claim 10, characterized in that at least sections (18) of the fluid-conducting passages (12) of the further cooling system run parallel to sections (19) of fluid-conducting passages (10) of the first cooling system, preferably in a direction perpendicular to the heat propagation direction.

13. The heating apparatus as claimed in claim 12, characterized in that at least sections (18) of the fluid-conducting passages (12) of the further cooling system and sections (19) of fluid-conducting passages (10) of the first cooling system are guided into one another.

14. The heating apparatus as claimed in one of claims 10 to 13, characterized in that the fluid-conducting passages (10) are arranged in such a way that at least a section (19) of the fluid-conducting passages (10) of the first cooling system is arranged closer to the melt contact surface (17) of the at least one electrode (3) than the fluid-conducting passages (12) of the further cooling system.

15. The heating apparatus as claimed in one of claims 1 to 14, characterized in that the at least one electrode (3) comprises a supporting apparatus (5).

16. The heating apparatus as claimed in claim 15, characterized in that the supporting apparatus (5) is arranged on a side of the electrode (3) that is remote from the melt contact surface (17).

17. The heating apparatus as claimed in one of claims 15 or 16, characterized in that the supporting apparatus (5) is of multilayer structure.

18. The heating apparatus as claimed in claim 18, characterized in that the support apparatus (5) includes a first layer (51), which is arranged between the electrode (3) and at least one subsequent second layer (52) of the supporting apparatus (5), the first layer (51) having a higher thermal conductivity than the second layer (52).

19. The heating apparatus as claimed in claim 19, characterized in that the first layer (51) comprises a fused-cast and/or dense-sintered material, in particular AZS or Al_2O_3 or HZFC.

20. The heating apparatus as claimed in one of claims 15 to 19, in which that side of the at least one electrode (3) which is remote from the melt contact surface (17) bears against one side (20) of the supporting apparatus (5), characterized in that at least a section (19) of a fluid-conducting passage (10) extends along this side (20) of the supporting apparatus (5).

21. The heating apparatus as claimed in claim 20, characterized in that the section (19) of the at least one fluid-conducting passage (10) is open toward the electrode (3) or, in the case of a supporting apparatus (5) of multilayer structure, toward a first layer (51), arranged between electrode (3) and at least one subsequent second layer (52), of the supporting apparatus (5).

22. The heating apparatus as claimed in one of claims 1 to 21, characterized in that the at least one electrode (3) comprises at least two electrode segments (61, 63).

23. The heating apparatus as claimed in claim 22, characterized in that the electrode segments (61, 63) are insulated with respect to one another.

24. The heating apparatus as claimed in one of claims 1 to 23, characterized in that the at least one electrode (3) includes a melt contact material (2) which comprises electrically conductive ceramic, such as for example SnO_2 ceramic, and/or refractory metals, in particular high-melting

metals, in particular tungsten, molybdenum, osmium, hafnium, tantalum or alloys thereof, and/or platinum metals, in particular platinum, iridium, rhodium or alloys thereof.

25. The heating apparatus as claimed in one of claims 1 to 24, characterized in that the at least one electrode (3) includes a melt contact material (2) which comprises a fine-grain-stabilized material, in particular a high-strength platinum material or iridium material.

26. The heating apparatus as claimed in one of claims 1 to 25, characterized in that the at least one electrode (3) forms a wall region of a crucible, in particular of a skull crucible.

27. The heating apparatus as claimed in one of claims 1 to 26, characterized by at least one temperature sensor, in particular a thermocouple.

28. The heating apparatus as claimed in one of claims 1 to 27, characterized in that at least the first cooling system comprises at least one flowmeter.

29. The heating apparatus as claimed in one of claims 1 to 28, characterized by heating power control, in particular heating current control for controlling the heating current as a function of the cooling power, the melting temperature and/or the electrode temperature.

30. The heating apparatus as claimed in one of the preceding claims, characterized by a device for heating the electrode (3).

31. The heating apparatus as claimed in claim 30, characterized in that the device for heating the electrode

(3) comprises an ohmic heating device which is suitable for heating the melt or glass contact material and/or parts of the electrode itself.

32. The heating apparatus as claimed in claim 30 or 31, characterized in that the device for heating the electrode (3) comprises a device for heating the cooling fluid.

33. The heating apparatus as claimed in one of claims 1 to 32, characterized in that it can be fitted into the wall (42) of a melting unit (40) and forms part of the wall (42) of the melting unit (40).

34. The heating apparatus as claimed in claim 33, characterized in that the edges of the heating device (1) are cooled in the region in which they adjoin the walls (42) of the melting unit (40).

35. A melting unit (40) for the conductive heating of melts (39), comprising at least one heating apparatus (1) as claimed in one of the preceding claims.